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EXAMINER	
SINGH, DALZID E	

ART UNIT	PAPER NUMBER
2613	

NOTIFICATION DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Supplemental Notice of Allowability	Application No. 10/562,431	Applicant(s) YOSHINO ET AL.	
	Examiner Dalzid Singh	Art Unit 2613	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *28 December 2005*.

2. ☒ The allowed claim(s) is/are *1-20 and 22-53 which have been renumbered as 1-52 respectively*.

3. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☒ All b) ☐ Some* c) ☐ None of the:
   1. ☒ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
   1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

/Dalzid Singh/
Primary Examiner
Art Unit 2613

DETAILED ACTION

Allowable Subject Matter

1. Claims 1-20 and 22-53 are allowed.

2. The following is an examiner's statement of reasons for allowance:

Claim 1 is allowed because the prior arts of record do not disclose of teach an optical communications system using optical codes, characterized by: an optical transmitter which:

transmits, for each piece of data of a binary data sequence, an optical code signal whose optical intensity-frequency characteristic is at least one of a function Ci(f) and a complementary function (1-Ci(f)) of the i-th code corresponding to the value of said each piece of data of the binary data sequence, at least over an optical frequency width FSR;

said function Ci(f) is a periodic function with an optical frequency f as a variable, expressed as Ci(f)=Ci(f+FSRi);

the optical frequency width FSR is an optical frequency width which is a common multiple of a repetition period FSRi of a function forming each code in an optical frequency range from a predetermined optical frequency Fst to a predetermined optical frequency Fla;

the complementary function of the function Ci(f) is a function obtained by subtracting the function Ci(f) from 1;

the function Ci(f) and the complementary function (1-Ci(f)) bear the following relation:

∫Ci(f)Ci(f)df > ∫Ci(f)(1-Ci(f))df where ∫df is a definite integral with respect to f for an arbitrary interval FSR in the optical frequency range from Fst to Fla; and

the function Ci(f), a function Cj(f) of an arbitrary j-th code other than the i-th code and the complementary function (1-Cj(f)) of the function Cj(f) bear the following relation:

∫Ci(f)Cj(f)df = ∫Ci(f)(1-Cj(f))df; and

an optical receiver which includes: generates from said received optical signal corresponding to the difference between a first intensity signal corresponding to the optical intensity of an optical signal whose optical intensity-frequency characteristic is Ci(f) based on the function Ci(f) and a second intensity signal corresponding to the optical intensity of an optical signal whose optical intensity-frequency characteristic is (1-Ci(f)) based on the complementary function (1-Ci(f)); and regenerates said data sequence from said first difference signal.

Claim 10 is allowed because the prior arts of record do not disclose of teach an optical transmitter, which:

receives a binary data sequence and an optical signal; and

generates by and transmits from said encoder an optical code signal whose optical intensity-frequency characteristic is at least one of said functions Ci(f) and (1-

Ci(f)) of said i-th code corresponding to the value of each piece of data of said i-th binary data sequence at least in the optical frequency width FSR; wherein:

said function Ci(f) is a periodic function with an optical frequency f as a variable, expressed as Ci(f)=Ci(f+FSRi);

an optical frequency width is the optical frequency width FSR which is a common multiple of a repetition period FSRi of a function forming each code in said optical frequency range from the predetermined optical frequency Fst to the predetermined optical frequency Fla;

the complementary function (1-Ci(f) of the function Ci(f) is a function obtained by subtracting said function Ci(f) from 1;

said functions Ci(f) and (1-Ci(f)) bear the following relation:

∫Ci(f)Ci(f)df> ∫Ci(f)(1-Ci(f))df where ∫df is a definite integral with respect to f for an arbitrary interval corresponding to said optical frequency width FSR contained in the optical frequency range from the optical frequency Fst to the optical frequency Fla;

said function Ci(f), a function Cj(f) of an arbitrary j-th code other than the i-th code and a complementary function (1-Cj(f)) of said function Cj(f) bear the following relation: ∫Ci(f)Cj(f)df= ∫Ci(f)(1-Cj(f))df.

Claim 22 is allowed because the prior arts of record do not disclose of teach an optical receiver characterized by:

filter means which permits the passage therethrough of an optical signal having an optical intensity-frequency characteristic based on a function;

intensity detecting means for detecting the optical intensity of said optical signal;

and means for adding together or subtracting the intensity signals from each other; and

which is supplied with the received optical signal and regenerates data corresponding to the difference between:

a first intensity signal corresponding to the optical intensity of an optical signal having an optical intensity-frequency characteristic Ci(f) based on a frequency characteristic function Ci(f); and

a second intensity signal corresponding to the optical intensity of an optical signal having an optical intensity-frequency characteristic (1-Ci(f)) based on the complementary frequency function (1-Ci(f)); wherein:

said function Ci(f) is a periodic function expressed as Ci(f)=Ci(f+FSRi), the value of the function Ci(f) being in the range of 0 to 1;

an optical frequency width FSR is an optical frequency width which is a common multiple of a repetition period FSRi of a function forming each code in the optical frequency range from the predetermined optical frequency Fst to the predetermined optical frequency Fla;

said complementary function of the function Ci(f) is a function obtained by subtracting said function Ci(f) from 1;

said functions Ci(f) and (1-Ci(f)) bear the following relation:

$\int Ci(f)Ci(f)df > \int Ci(f)(1-Ci(f))df$ where $\int df$ is a definite integral with respect to f for an arbitrary interval FSR corresponding to said optical frequency width FSR contained in said optical frequency range from the optical frequency Fst to the optical frequency Fla; and

said function Ci(f), a function Cj(f) of an arbitrary j-th code Cj(f) other than said i-th code and the complementary function (1-Cj(f)) of said function Cj(f) bear the following relation: $\int Ci(f)Cj(f)df = \int Ci(f)(1-Cj(f))df$.

Claim 32 is allowed because the prior arts of record do not disclose of teach reflective optical communication equipment which is supplied with a received optical signal and a binary data sequence, modulates the received the optical signal to an optical signal whose optical intensity-frequency characteristic is a function with an optical frequency f as a variable, and transmits the modulated optical signal, and which characterized by:

an encoder which is supplied with said received optical signal of at least an optical frequency width FSR and outputs an optical signal by an optical filtering frequency characteristic of a first function Ci(f);

a complementary encoder which is supplied with said received optical signal and outputs a complementary optical signal filtered by a filtering optical frequency characteristic of a complementary function (1-Ci(f)); and

selective combining means which selectively combines, according to the value of each piece of data, the optical signal and the complementary optical signal and transmits them as an optical code signal;

wherein: said function Ci(f) is a periodic function expressed as Ci(f)=Ci(f+FSRi), the value of said function Ci(f) being in the range of 0 to 1;

said optical frequency width FSR is an optical frequency width which is a common multiple of a repetition period FSRi of a function forming each code in said optical frequency range from the predetermined optical frequency Fst to the predetermined optical frequency Fla;

the complementary function of said function Ci(f) is a function obtained by subtracting said function Ci(f) from 1;

said function Ci(f) and (1-Ci(f)) bear the following relation:

$\int Ci(f)Ci(f)df > \int Ci(f)(1-Ci(f))df$ where $\int df$ is a definite integral with respect to f for an arbitrary interval corresponding to said optical frequency width FSR in the optical frequency range from the optical frequency Fst to the optical frequency Fla; and

said function Ci(f), a function Cj(f) of an arbitrary j-th code other than said i-th code and the complementary function (1-Cj(f)) of said function Cj(f) bear the following relation: $\int Ci(f)Cj(f)df = \int Ci(f)(1-Cj(f))df$.

Claim 40 is allowed because the prior arts of record do not disclose of teach an optical communications system using optical codes, characterized by:

an optical transmitter provided with:

multiple light sources for emitting optical signals of optical frequencies corresponding to MU = V chips each having a chip width that is a unit optical frequency width into which an optical frequency width FSR contained in an optical frequency range from a predetermined optical frequency Fst to a predetermined optical frequency Fla is divided by a natural number M and an integer U equal to or greater than 3;

drive signal generators for generating drive signals for said multiple light sources;

an optical combiner for combining the output lights from said multiple light sources and outputting the combined light as an optical code signal; and

code modulating means which is inserted between said multiple light sources and said drive signal generators or said optical combiner and controlled by each piece of data of an i-th binary data sequence to make said optical code signal have an optical intensity-frequency characteristic based on at least one of said i-th code function Ci(f) and its complementary function (1- Ci(0); wherein:

said optical frequency width FSR is an optical frequency width which is a common multiple of a repetition period PFRi of a function forming each

code in said optical frequency range from the predetermined optical frequency Fst to the predetermined optical frequency Fla;

said complementary function of the function Ci(f) is a function obtained by subtracting said function Ci(f) from 1;

said functions Ci(f) and (1 - Ci(f)) bear the following relation:

$\int Ci(f) * Ci(f)df > \int Ci(f) * (1 - Ci(f))df$

where $\int df$ is a definite integral with respect to f for an arbitrary interval corresponding to said optical frequency width FSR contained in said optical frequency range from the optical frequency Fst to the optical frequency Fla; and

said function Ci(f), a function Cj(f) of an arbitrary j-th code other than said i-th code and the complementary function (1 - Cj(f)) of said function Cj(f) bear the following relation:

$\int Ci(f) * Cj(f)df = \int Ci(f) * (1 - Cj(f))df$; and

an optical receiver which includes:

at least optical filter means and an intensity detector for detecting the optical intensity of the optical signal received by said optical receiver; and which:

generates from said received optical signal a first difference signal corresponding to the difference between a first intensity signal corresponding to the optical intensity of an optical signal whose optical intensity-frequency characteristic is Ci(f) and a second intensity signal corresponding to the optical intensity of an optical signal whose optical intensity-frequency characteristic is (1 - Ci(f)); and

regenerates said data sequence from said first difference signal.

Claim 46 is allowed because the prior arts of record do not disclose of teach an optical transmitter, comprising:

multiple light sources for emitting optical signals of optical frequencies corresponding to MU = V chips each having a chip width that is a unit optical frequency width into which an optical frequency width FSR contained in an optical frequency range from a predetermined optical frequency Fst to a predetermined optical frequency Fla is divided by a natural number M and an integer U equal to or greater than 3;

drive signal generators for generating drive signals for said multiple light sources;

an optical combiner for combining the output light from said multiple light sources and outputting it as an optical code signal; and

code modulating means, which is inserted between said multiple light sources and said drive signal generators or said optical combiner and controlled by each piece

of data of an i-th binary data sequence to make said optical code signal have an optical intensity-frequency characteristic based on at least one of said i-th code function Ci(f) and its complementary function (1- Ci(O); wherein:

said optical frequency width FSR is an optical frequency width which is a common multiple of a repetition period PFRi of a function forming each code in said optical frequency range from the predetermined optical frequency Fst to the predetermined optical frequency Fla;

the complementary function of said function Ci(f) is a function obtained by subtracting said function Ci(f) from 1;

said functions Ci(f) and (1 - Ci(f)) bear the following relation:

∫Ci(f) * Ci(f)df> ∫Ci(f) * (1 - Ci(f))df where ∫df is a definite integral with respect to f for an arbitrary interval corresponding to said optical frequency width FSR contained in said optical frequency range from the optical frequency Fst to the optical frequency Fla; and said function Ci(f), a function Cj(f) of an arbitrary j-th code other than said i-th code and the complementary function (1 - Cj(f)) of the said function Cj(f) bear the following relation:

∫Ci(f) * (Cj(f)df = ∫Ci(f) * (1 - Cj(f))df.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

3. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Alamouti et al (US Patent No. 6,560,209) is cited to show method for frequency division duplex communications.

Kahn et al (US Patent No. 6,592,274) is cited to show transmission and reception of duobinary multilevel pulse-amplitude-modulated optical signals using finite-state machine-based encoder.

Mogre et al (US Pub. No. 2004/0047433) is cited to show method and/or apparatus to efficiently transmit broadband service content using low density parity code based coded modulation.

Wada et al (US Patent No. 7,177,544) is cited to show photonic network packet routing method and packet router for photonic network.

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dalzid Singh whose telephone number is (571) 272-3029. The examiner can normally be reached on Mon-Fri 9am - 5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jason Chan can be reached on (571) 272-3022. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Dalzid Singh/
Primary Examiner
Art Unit 2613